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Docket No. 0756-1400
TECHNOLOGY CENTER 2800

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re PATENT application of)
Shunpei YAMAZAKI et al.)
Serial No. 08/520,079) Group Art Unit: 2815
Filed: August 28, 1995) Examiner: J. Jackson, Jr.
For: SEMICONDUCTOR CIRCUIT FOR)
ELECTRO-OPTICAL DEVICE)
AND METHOD OF)
MANUFACTURING THE SAME) Date: February 29, 2000

#31 / Response
T. Y. Wang
3.3.02

RESPONSE

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

The Office Action of November 29, 1999 was received and carefully reviewed. Reconsideration and withdrawal of the currently pending rejections are requested for the reasons advanced in detail below.

Claims 73-144 are currently pending in the instant application.

Claims 73-144 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhang, U.S. Patent No. 5,614,733 or 5,604,360 or 5,563,426, in view of Yamazaki, U.S. Patent No. 5,543,636. This rejection is traversed for the reasons advanced below.

Applicants incorporate by reference the arguments provided in the *Amendment* filed August 31, 1999. Specifically, the present invention is directed to a thin film transistor wherein at least a channel region is intentionally formed

in a region where no grain boundary exists. No reference teaches how the channel region is formed on the region having no grain boundary.

Further, the semiconductor island includes carbon, nitrogen at a concentration no higher than $5 \times 10^{18} \text{ cm}^{-3}$ and oxygen at a concentration of not higher than $5 \times 10^{19} \text{ cm}^{-3}$.

As previously asserted, the location of a crystalline semiconductor island of the claimed invention, in particular, a channel forming region, is intentionally formed in a monodomain region by patterning a crystallized semiconductor film, so that the crystalline semiconductor island has no grain boundary. The Examiner's attention is again directed to Figs. 2B and 4B where the specific feature is first noted in the present application.

The cited reference to Zhang et al. '733 teaches that local concentrations of catalytic material "(e.g. those at grain boundaries)" (emphasis added) are preferably not in excess of $1 \times 10^{20} \text{ cm}^{-3}$ (See, column 3, lines 16-17). Further, Zhang et al. '733 discusses "barriers" at "grain boundaries," which could not be removed if only thermal annealing is conducted, can be "lowered" (emphasis added). In addition, "even amorphous components remaining at the grain boundaries can be crystallized." (See, column 4, lines 5-13). As a result, there is no indication that the semiconductor islands of Zhang et al. are formed in a monodomain region of the semiconductor.

The Examiner states on page 3 of the Office Action that the text of Zhang '733 "removes" the grain boundaries. This is not accurate, since as previously provided and repeated again above, the actual disclosure of Zhang et al. at col. 4, lines 5-13 states that the grain boundaries are "lowered." (See, col. 4, line 8 thereof). No doubt, crystallinity in Zhang '733 is improved, but there is

absolutely no suggestion or disclosure that the grain boundaries are removed, as required by the claims of the instant application.

With regard to Zhang et al. '360, the disclosure includes numerous references to the "grain," namely, that the speed of the crystal growth after the production of nucleus also remarkably increases in the crystallization of the amorphous silicon thin film formed on a certain metal after forming it when the growth of the crystal "grain" after the production of nucleus is studied by varying heating time (See, column 3, lines 1-16).

The Examiner contends on page 3 of the Office Action that col. 9, lines 13-22 recites that the active layer may be structured by the crystalline silicon film grown in the direction parallel to the substrate if the length is with 40 microns. This does not, however, relate to a monodomain region. As provided in col. 9, lines 7-12, the parallel relationship of the crystal growth is provided in the lateral direction, parallel to the substrate, as provided in Figure 2B. This lateral crystal growth does not mean monodomain, namely, no grain boundaries, as recited in the instant claims. This is made abundantly clear by the disclosure at col. 3, lines 16-17 discussing local concentrations at "grain boundaries" of catalytic material.

Therefore, Applicants continues to contend that neither '733 nor '360 relate to forming the semiconductor island in a region where no grain boundary is included. Accordingly, neither of the Zhang references teach the crystal boundaries are much larger than the length of the channel regions, as suggested by the Examiner.

As previously provided, an exact location of the semiconductor island or the channel forming region shown in Figs. 2B and 4B of the present specification is not determined or disclosed. It is noted in Zhang '426 because the end portion of the crystallization includes the metal element higher than other portions, an


electrical property of the semiconductor element will be prevented by such the metal element. Therefore, there is also no teaching or suggestion in the '426 reference that the semiconductor island be formed in a monodomain region.

On the other hand, according to the claimed invention, at least the channel forming region is formed inside the monodomain, so that it can avoid the presence of any grain boundary in the channel forming region. As a result, the present invention is patentably distinguishable from the cited references.

Claims 123 and 129 are again rejected under 35 U.S.C. 112, second paragraph. The S value of the monodomain is shown in Fig. 5 and a researcher in the art is familiar with an "S-value" or "S-factor", as included in the Appendix A submitted with the Amendment filed August 31, 1999. As a result, this rejection should be overcome.

In view of the foregoing, it is respectfully requested that the rejections of record be reconsidered and withdrawn by the Examiner, that claims 73-144 be allowed, and that the application be passed to issue. If a conference would expedite prosecution of the instant application, the Examiner is hereby invited to telephone the undersigned to arrange such a conference.

Respectfully submitted,



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